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ABSTRACT

A study was conducted at the Moffitt Undergraduate Library of the University of California at Berkeley to determine the extent and the cost of book losses due to theft and to determine the cost-effectiveness of book security systems. A sample inventory was taken and the theft rate (13.7%) was statistically derived. The rate of loss was translated into a cost figure, projected over time, and compared with the cost of book security systems. It was shown that the cost of installing and operating a security system was far less than the projected cost of book thefts. (EMH)

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A REPORT ON THE MOFFITT UNDERGRADUATE LIBRARY BOOK THEFT STUDY

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and
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March 1975

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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INTRODUCTION AND STATEMENT OF THE PROBLEM

The purpose of this study was twofold: (1) to determine the extent of book losses due to theft in the Moffitt Undergraduate Library, and (2) to determine the cost effectiveness of book security systems for the Moffitt Undergraduate Library. The first purpose was met by conducting a sample inventory of the monograph collection in Moffitt. The second purpose was met by interpreting the statistical findings of the sample inventory in economic terms and making recommendations regarding the cost effectiveness of a book security system for the Moffitt Undergraduate Library.

The staff of the Moffitt Undergraduate Library believe their library to be incurring significant book losses as a result of theft. A complete inventory of select parts of the collection carried September 1974 (attachment #1) affirmed this belief.

A complete inventory of the Library's monograph collection was ruled out because of the collection's size and dynamic nature. The expense and disruption to library services also ruled against a complete inventory. Therefore, a sample inventory was decided upon in an effort to statistically estimate the level of book theft. Once the level of loss was obtained, an economic value of the lost materials could be set and the cost effectiveness of book security systems could be evaluated. Part two of this report covers the costing and evaluation of these systems and their cost effectiveness for the Moffitt Undergraduate Library.

PART I: THE SAMPLE INVENTORY

METHODOLOGY USED

To determine the extent of book losses due to theft in the Moffitt Undergraduate Library, a collection status model was used. This model assumes that the total number of volumes in a given library's collection, LC, would be a function of those volumes identified by their relative location at a particular instant of time:

$$LC = f(B, M, C, I, S, R, K)$$

where:

B = the number of volumes on the shelves in their correct locations

M = the number of volumes misshelved

C = the number of volumes being held for or checked out to patrons, repair, binding, interlibrary loan, etc.

I = the number of volumes in use or just lying about within the library but not checked out

S = the number of volumes stolen

R = the number of volumes needing to be reshelved, located on book trucks or shelves used to hold books that need to be reshelved

K = the number of volumes known to be missing.

Since a library's total collection would be a sum of each of the above items, the sum would be a linear expression:

$$LC = B + M + C + I + S + R + K$$

This collection status model was reduced by assessing the Moffitt Undergraduate Library's collection when it was not in use (a Saturday morning before opening). The previous night was spent clearing off tables and returning materials to their correct locations on the shelves. In addition, all materials on book trucks were returned to their correct locations on the shelves. By making the assessment when the collection was static (building closed) and when all materials were shelved, the value of I and the value of R went to zero and the model was reduced as follows:

$$LC = B + M + C + S + K$$

To obtain percentages for all of the factors in this collection status model, a two part experiment was conducted. The first part of the experiment was done to determine the percentage of volumes missing from the Library. A random sample of titles was drawn from the shelflist. A random number table was used to select cards from the shelflist for the sample. A random number was selected for both the drawer and distance into the drawer. The shelflist cards for the titles selected were removed from the shelflist and photo copied onto a searching form. The shelflist card was read (front and back) to learn how many physical volumes the Library possessed of each title. This information was noted on the searching form. The following page is an example of a search form used. These forms were grouped by shelf location and put into packets of 15 to 20 each. Then the physical volumes were searched. From this search it was determined how many volumes were on the shelves in their correct positions (B), how many were held or checked out to patrons, binding, etc. (C), and how many were known to be missing (K). The volumes which were not located were those that either were misshelved (M)

SHELF READING DATA

OPEN STACKS

Number of volumes on a target shelf which are more than one half shelf (about two running feet) from where they should be shelved. 0

CLOSED STACKS

Number of volumes on a target shelf which are more than one half shelf (about two running feet) from where they should be shelved. _____

Q125 K4

Kearney, Hugh F ed.

Origins of the scientific revolution [by] Hugh Kearney. [London] Longmans [1964]

xv, 159 p. 22 cm. (Problems and perspectives in history)

Bibliography: p. 156.

1. Science--Hist. I. Title.

Q125.K4

UNDERGRAD. LIB.

Library of Congress

OFFICIAL

65-9213

15 16 1 3 5 6 7 8 9 10 11 12 13 14

# of volumes per copy	Reference: Noted on Card	Reference: On Shelf	In Stacks: open	In Stacks: closed	In Open Stac. Circ. Files: Reg.	In Open Stac. Circ. Files: Ov. D.	In Missing Files: Old	In Missing Files: New	In 2 Hour Circ. Files: Reg.	In 2 Hour Circ. Files: Ov. D.	Bindery File:	Hold Shelves	Bind. & Label Area	Not Found (Vols)	Follow Up
1 2 3		✓													
1 2		0	0	0	0	0	0	0	0	0	0	0	0	1	
1 2		✓													
1 2 3															
1 2 3															
1 2 3	

or stolen (S), assuming they were not mislabeled. Thus, for the reduced model we know the percentages for the factors B, C, R, K, and M + S.

The second part of the experiment determined the last two percentages. The methodology used to find these percentages made use of the following model:

$$m = S + M$$

where:

m = missing, a volume not on the shelf in its correct position (B), not checked out (C), and not those known to be missing before the experiment (K)

S = stolen

M = misshelved

The objective of this part of the experiment was to find the percentage of misshelved volumes. This was done by reading the shelves upon which the volumes were located or should have been located when doing the search for the volumes (model factor B) and noting the number of misshelved volumes on the search form. Volume numbers and copy numbers, if out of sequence, were not classed as misshelved. Volumes within half of a shelf to each side of the location where the specific item should have been located were checked for misshelving. Then by using the ten volumes per foot rule and by counting the number of volumes misshelved, the percentage of misshelved volumes (M) was identified. Taking the percentage of volumes that were not located initially and the percentage of misshelved volumes determined by the second part of the experiment and using the model

$$m = S + M$$

the percentage of stolen volumes was found by subtracting M from both sides of the model in the following manner:

$$\begin{array}{r} m = M + S \\ -M \quad -M \\ \hline S = m - M \end{array}$$

By so doing, percentages were determined for the elements in the model.

LIMITS OF THE STUDY

The size (number of physical volumes) of the collection was not known. Therefore, an additional experiment was conducted to provide this data. In this experiment the shelflist was measured by the standard method (compress cards, 1" = 100 cards). Only the part of the shelflist which records monographs was measured because serials are unclassed in the Moffitt Undergraduate Library. The unclassed pamphlet collection were also omitted from this study.

The statistical distribution assumed by the collection status model used is that of a polynomial which can be reduced to a binomial. Thus, the confidence level and the confidence interval were calculated assuming a binomial distribution.

RESULTS

1. Collection size (as a result of the measuring of the shelflist).

   123,000 monograph volumes

2. Title to copy ratio (taken from the data collection on search forms).

   1 to 1.75

3. Titles to physical volumes ratio (taken from the data).

   1 to 1.90

4-5. A sample of 991 titles (1883 physical volumes) randomly selected from the shelflist and searched for in the collection have provided the following profile of the monograph collection of the Moffitt Undergraduate Library.

	Physical volumes	Percentages
Books in their correct location on the shelf	1456	77.32
Books in Circulation file		
a. checked out	118	6.27
b. being held	3	.16
Books at the Bindery	6	.32
Books recorded missing before the sample inventory	38	2.02
Books misshelved*		.21
Books missing as a result of theft (assumption)	262	13.70
Total	1883	100%

*misshelved was defined as being out of place by more than one half a shelf.

The above collection profile is a statistical estimate. This estimate is made at the 99% confidence level and within a confidence interval of 1.74%.

In other words, if we repeated this sample inventory one hundred times with a different sample each time, we would find in ninety-nine cases that the percentage of monographs missing from the Moffitt Undergraduate Library as a result of theft would be between 11.96 and 15.44 (13.70 ± 1.74).

Neal K. Kaske
Library Systems Office

PART II: THE COST-EFFECTIVENESS ANALYSIS

METHODOLOGY

It was necessary to estimate the size and cost of the Moffitt Undergraduate Library monograph collection in order to estimate the annual dollar loss rate. It was intended to determine how many years' losses would be required to offset the costs of acquisition and installation of an Electronic Security System (ESS).

Estimation of the monograph collection size was accomplished by determining how many monographs were included in the Moffitt shelflist. Four hundred samples of 20 millimeters of cards each were randomly selected. The number of cards, titles and volumes found in each of these samples was tabulated. Averages were calculated. The total number of millimeters of cards was obtained by measuring the entire shelflist (24,291 mm). Total number of cards, titles and, separately, volumes in the shelflist were calculated by multiplying the appropriate average by the total number of millimeters of cards.

There are approximately 84,600 cards in the Moffitt shelflist. These cards represent approximately 67,500 titles. These titles represent 123,000 volumes. There are about 1.25 cards per title. Also there are about 0.69 cards per volume. There are approximately 1.82 volumes per title, including multiple copies and multi-volume monographs.

A total inventory of the Moffitt collection was conducted during the summer of 1971. It was concluded in August of that year, forty-one months

before the current study. At that time, the shelflist was updated. Cards for missing titles were removed. Missing volumes were noted on the shelf-list cards. Because this was done, it was possible to determine not only the gross losses from the collection, but also the average monthly and annual loss rates.

The results of the loss sampling study, as reported earlier in Mr. Kaske's section of this report, indicate that 2.02 percent of the Moffitt monograph collection was reported missing since August 1971, and that an additional 13.70 percent were found to have disappeared during the same period, but were not reported. In all, approximately 15.72 percent of the 123,000 monograph volumes were lost during this forty-one month period. Table I, p. 12, shows the current status of the collection.

If the losses occurred at a regular rate, month by month, year by year, this would amount to monthly losses of 472 volumes or 0.38 percent per month. Annually, Moffitt would have lost 5,670 volumes or 4.60 percent. Lan Dyson, Head Librarian at Moffitt, has indicated that the average cost of acquiring a monograph at that library is aproximately $10.00, and that the cost of technical processing for each volume is about $7.00. At a combined total of $17.00 to put each monograph volume on the shelf, monthly losses at Moffitt seem to be about $8,030, and annual losses amount to $96,400. Total monograph losses since August of 1971 represent approximately $329,000. If the title to volume ratio found in the larger sample loss rate study (1:1.9) were used for calculations instead of the smaller sample collection size study ratio (1.82), all of the loss and cost data would be revised upwards by 3.98 percent. Table II, p. 13, provides more detailed information on the rates and costs of losses.

Table I: Estimated
Status of Moffitt Undergraduate Library
Monograph Collection: January 1975

	Percentages	Physical volumes
Books in their correct location on the shelf	77.32%	95,300
Books in Circulation file		
a. checked out	6.27%	7,730
b. being held	.16%	197
Books at the Bindery	.32%	394
Books recorded missing before the sample inventory	2.02%	2,490
Books misshelved*	.21%	259
Books missing as a result of theft (assumption)	13.70%	16,900
Total	100.00%	123,000

*misshelved was defined as being out of place by more than one half a shelf.

Table II: Estimated
Costs of Losses from Moffitt Undergraduate
Library Monograph Collection

		Percent of Collection	Number of Volumes	Dollar Cost Including Processing
Total Losses from August 1971 to January 1975				
Previously reported missing		2.02%	2,490	$42,300
Found to be missing in study		13.70%	16,900	287,000
	Total	15.72%	19,400	$329,000
Annual Loss Rates				
Reported Missing		0.59%	728	$12,400
Found in study		4.01%	4,940	83,980
	Total	4.60%	5,670	$96,400
Estimated Cost of ESS system for Moffitt				$36,700

It should also be noted that this study covers only monograph losses. The General Library collection size tables indicate that there are a total of 146,123 total volumes at Moffitt. This study indicates that 123,000 of those are monograph volumes. This leaves 23,000 non-monograph volumes (mostly serials of various types). Some of these disappear as well. If the loss rate for non-monograph materials were similar to that for monographs, Moffitt would lose an additional 1060 serials volumes annually. However, because no data were available on losses of these materials, they were not included in the cost-effectiveness comparison except for calculating the cost of marking them for electronic detection.

COST-EFFECTIVENESS COMPARISON

The second part of the cost-effectiveness study was to determine the advisability of obtaining an electronic theft detection or electronic security system (ESS)for the Moffitt Undergraduate Library. Manufacturers (Book-Mark and Tattle-Tape) have supplied cost data for installation and maintenance of ESS systems. Purchasing and installing a three gate ESS system should be approximately $25,000. This cost will vary, depending upon how much physical modification of the building would be necessary, and how eager the manufacturers are to install the first ESS at UC Berkeley. An additional cost involves the purchase and installation of target strips in books. The average cost of targets is approximately $.10 each, and the average cost of installing them seems to be about $.06 each. If targets were installed in half of Moffitt's 146,123 volumes (this total includes non-monograph volumes) at the outset, the total cost would be approximately

$11,690. Therefore, the total initial installation and set-up costs would be approximately $36,690.

Reports from other library systems indicate that ESS systems generally eliminate not less than 75 percent of normal losses. If this were the case at Moffitt, the annual cost of loss would be reduced from $96,400 to $24,100 or less. This would result in a savings of about $72,300 per year. Phrased another way, if the system were about 75 percent effective, it would take about six months of reduced losses to pay for itself.

It is, therefore, strongly recommended that system requirements be drafted for acquisition of an ESS and that an Electronic Security System be acquired and installed at Moffitt.

Donald D. Thompson
Special Projects

ADDENDUM: THE COST OF THE STUDIES

It was felt that data on the cost of conducting these studies would be useful for determining where and when such studies should be done in the future.

The most time consuming and expensive operation was the determination of the collection size. About 175 paid hours were required for this study. The approximate cost of this portion of the study was $750.

The second portion of the study involved the study of losses. About 60 hours were used in stack preparation and reshelving, eight hours were involved in drawing the sample, forty-six hours were involved in stack and file checking, for a total of about 114 hours. The cost for this phase was about $485.00.

In addition, Neal Kaske of the Library Systems Office and Donald Thompson of Special Projects contributed about eighteen hours each. Had they been paid for this effort, that cost would have been about $280.

The total nominal cost for all phases of the project was, therefore, about $1500. Of this total, about $375 was contributed time, provided by Mr. Kaske, Mr. Thompson, and the Moffitt Library professional staff.

(Attachment #1)

INVENTORY 1974

Section inventoried	Official file inch	# copies to Inv.	# msg. in Inv.	Msg. prior to Inv. *	Total	Percent Missing
BF (psychology)	9 1/2	1,938	245	16/86	347	17.9
DT25-40 (African History)	1 1/2	204	33	7/16	56	27.5
E184-185.97 (Ethnic studies)	8 1/2	1,257	399	13/97	509	40.5
E441-453 (Black History in U.S.)	1 1/2	270	66	2/18	86	31.9
H61-62 (Soc.Sci. - general)	1 5/16	361	40	2/15	57	15.8
HB171-171.5 (Econ. theory. Engl. and Amer. Texts)	2 1/2	509	63	1/15	79	15.5
HB501 (Econ.- Capital. Saving)	3/4	155	21	6/25	52	31.5
HD2789-4999 (Industry, Labor)	2 1/2	389	17	4/12	33	8.5
HQ1-471 (Soc. - Sexual behavior)	1 7/8	265	73	13/9	95	35.8
HQ1101-end HQ (Soc. - women)	1 3/4	280	66	2/20	88	31.4
HT1505-1583 (Soc. - race)	7/16	82	15	0/5	20	24.4
HV6016-end HV(Soc.-crim.)	2 3/16	871	130	11/32	173	19.9
HX36-276 (Socialism/Communism)	4	569	93	0/44	137	24.1
JK1800-9999(Pol.Sci. - U.S.)	3	370	19	2/3	24	6.5
PN1993-1999 (Film)	3	511	121	3/32	156	30.5
PR2750-2900(Shakespeare)	3 1/2	458	60	2/18	80	17.5
QC21-88 (Physics)	1 1/2	427	103	2/52	157	36.8
TR1-898 (Photography)	1/2	38	21	4/5	30	78.9
TOTAL	49 6/8	9,123	1,585	594	2,179	23.9

* Number infront of slash = declared missing after May 1974.
Number after slash = declared missing 1972-Apr. 1974.

Figures do not include the number of volumes we have withdrawn from these sections in the last 3 years.

Time used = 119 GA hours. (Included: counting volumes, checking shelves and files, making snag cards, refiling official, and then searching each section twice)

Submitted by Ann Wall
Spptember 5,1974